

Ralph W. Chaney
on the DAWN
REDWOODS
of CHINA

Pacific Discovery



"LIVING FOSSIL"—METASEQUOIA

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IN THIS ISSUE: *Ralph W. Chaney*

Weldon D. Woodson • Earle G. Linsley • Joseph R. Slevin

A Letter from Joel Hedgpeth

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Pacific Discovery

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Pre-Discovery:

Strange that an island in continental American waters should, from its first tentative appearance on a chart over four centuries ago down to our own times, have managed to mystify seafarers as to its existence, its whereabouts, and its nature. "But Cocos had an elusive quality which it has not completely lost even yet," William Beebe wrote (*The Arcturus Adventure*, 1926). As late as 1846 the French Admiralty needed a hydrographic survey, sailing directions, and accurate description of this most famous of "buried-treasure" islands, which lies less than 350 miles off the Pacific coast of Costa Rica. Accordingly, the brig-of-war *Le Génie* was ordered to those waters; she raised Cocos "just about where it should be"; her officers surveyed its rocky shores and explored its jungle interior. Before weighing anchor, after a number of days, she left her signature, "BRICK de S. Mté. LE GENIE," and the date, "1 Nov. 1846," nicely chiseled in a boulder on shore. At sea, her captain sat down forthwith to write the necessary report to his admiral, while the survey officers smoothed out their boat sheets for the Admiralty's cartographers. An introductory note to "Report on Cocos" in *PD's* next issue will tell how a transcript of this report, in French, together with tracings of *Le Génie's* survey sheets, came into the hands of an Academy curator interested in the history of discovery. Alive with the spirit of discovery, the report appears in print for the first time—so far as we know—in English translation.

Borys Malkin is on Roads to Discovery in North Africa. Just in time for this squib, the Editor got a closely written letter which Borys mailed by air from Tunis as he headed due south across the Sahara for Lagos, Nigeria. It is about ancient Phoenician and Roman cities, modern deserts, Dervishes, Berbers, and beetles.

Discovering PD's Authors:

A kind of detective who gets little publicity and no movie scripts dealing with his exploits is the paleon-

tologist. If he is, moreover, like **Ralph W. Chaney**, a paleobotanist—even one so eminent, he is almost sure to enjoy complete freedom from public notice. Diplodoci are good copy, but not fossil Sequoia twigs. But the author of "Redwoods Around the Pacific Basin," Professor of Paleontology and Curator of the Museum of Paleontology in the University of California, Berkeley, suddenly found himself on the front page last March in dispatches from China. The lifetime of patient, unspectacular investigation—detective work, reported in scientific journals, by which Dr. Chaney has made known the past distribution over three continents of the great redwoods surviving only in California and Oregon—had taken a wildly unexpected turn: the corpse came to life.

Weldon D. Woodson, who watches the watcher of "He Watches Them Grow," is a most prolific writer on nature subjects and a naturalist himself. He is co-author (with Raymond W. Thorp) of *Black Widow, America's Most Poisonous Spider* (1945), a book resulting from ten years of research.

Dr. Earle G. Linsley is here again with a seasonal star chart, and something about November meteorites. He is interested in coördinating observations which may lead to the finding of meteorites that fall to the ground.

If you've read the *Log of the Schooner "Academy"* (Calif. Acad. Sci., 1931), you know **Joseph R. Slevin**'s zest for travel, especially if it's over the ocean in a boat and there's a Galápagos or Australia full of uncaptured reptiles on the other side. His last of three trips to "A Reptile Hunter's Australia" was necessarily by air, but the Academy's Curator of Reptiles found Roads to Discovery on the underside continent as rewarding as ever.

Neither mining men, engineers, fishermen, nor biologists may have the final word on the questions introduced in "Gold, Men and Fish" (*PD*, March–April 1948). "A Letter from **Joel Hedgpeth**" warns that a last dusty answer may be written in California river beds dried by the water needs of too many people.

D. G. K.

A JOURNAL OF NATURE AND MAN IN THE PACIFIC WORLD

FROM THE READER

SIRS:

I read with much interest "Gold, Men and Fish" by Joel Hedgpeth in your March-April issue, and responses by Walter Stalder and Roy H. Elliott in a later issue [July-August 1948]. It is feared that some of your readers have found these articles grounds for the opinion that salmon runs in Sacramento and San Joaquin Valleys are no longer large; whereas, they have been in recent years the largest for which we have any reliable record.

Very large runs of king salmon were seen in 1945, 1946, and 1947. In 1946 an estimated 1,500,000 king salmon made up the run, and from these the commercial fishery took about 325,000 or 22 per cent. Dr. Willis R. Rich reported that the Columbia River run of king salmon in 1938 was about 728,000 and that it produced a catch of 517,000 fish or 71 per cent.

It must be recognized that:

1. Our salmon runs are not being fully exploited.
2. Twenty-two per cent is a very low catch ratio for a salmon gill net fishery.

3. The risks of pollution, diversion, and drying of spawning areas found in our streams require a larger escapement than do the same risks in most other salmon rivers.

4. Wherever there is a poor salmon run in California today, the causes are to be found locally.

It is the opinion of the Bureau of Marine Fisheries, Division of Fish and Game, State of California, that there will be a net gain to the salmon run of the Yuba River when the next high dam is built if:

1. An efficient fish ladder is built over the Daguerre Point Dam.

2. An adequate screen is placed over the intake of the Hallwood diversion.

3. A year-round flow of 250 cubic feet per second is maintained, with a 500 c.f.s. minimum flow during the spawning season. This water could be diverted for domestic and irrigation use at any point below the confluence of the Yuba and Feather Rivers.

4. The title to certain of the tailings through which this stream runs be passed to the Bureau of Marine Fisheries in order that the most efficient use be made of the available water and stream bed.

RICHARD S. CROKER
Chief

Bureau of Marine Fisheries,
California Division of Fish and Game
San Francisco, September 14, 1948.

★
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who receives your gift of
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will thank you not only at Christmas-time
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but throughout the year
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EDITORIAL: OF MEN AND BEASTS

MAN'S RISE FROM SAVAGERY has been a long, slow pilgrimage, with many detours and reverses. Often when his progress has seemed most rapid and his hope for the future brightest, some rude setback has jolted him into a new realization of his closeness to the jungle.

Yet, however discouraging may be the conduct of this curious biped, however frequent his back-slidings, however mixed his motives or base his behavior, he has never—collectively and permanently—given up his dream of a better world, nor his struggle to achieve it. With his feet in the mire, he still gazes toward the stars.

By some curious alchemy, the selfsame circumstances that bring out the worst in human nature also call forth the best and highest of which mankind is capable. It takes temptation to make either a sinner or a saint. Adversity preys on weakness but it also fosters strength. Crisis may show us that some men are cowards, but it proves others heroes. We cannot despair of the human race so long as any men are brave, and so long as courage is esteemed a virtue.

The assassination in Jerusalem of Count Folke Bernadotte, agent of the United Nations on a mission of peace, is a disheartening event in a distracted world. With the distinguished Swedish count was slain a Frenchman, Colonel André Serot, senior United Nations observer in the area. As news of the tragedy was spread abroad on September 17, gloom settled over the hearts of men who had ventured to believe that civilization was nearing a new milepost, and that justice and reason might triumph over force and hate.

Like so many acts of violence, this one was self-defeating. Its perpetrators made immortal the man they sought to kill, and achieved for themselves only ignominy and futility. They might have learned from the past. Another Peacemaker was slain in Jerusalem nearly twenty centuries ago, and the cause in which He died has become the most potent single force in history in the past two thousand years. When an idea has taken hold upon the minds of men, it cannot be crucified, nor burned at the stake, nor killed with a Sten gun.

The assassination in Jewish-held territory of two United Nations officers has been a deep embarrassment to the Israeli government, and in some degree to Judaism everywhere—alike to those of its adherents who favor and those who oppose a Jewish state. But the unhappy incident serves chiefly to point up the fact that the Jewish problem is no different from the Gentile problem—the

Hindu problem, the Chinese problem, the American problem, the great human problem of how to restrain the forces of hate and violence, that men of good will may live together in peace and safety in an orderly world.

One aspect of the circumstances attending the death of Count Bernadotte and his French companion deserves particular comment. They had been fired upon earlier in the day, and the car in which they were riding had been hit. "I do not like to be shot at," the Count remarked dryly to a correspondent. Then he announced that he was proceeding into the area from which the shots had come. "Good luck," said the newsman. "I'll need it," the Count replied.

That kind of courage—cold courage we sometimes call it, the deliberate, unswerving attention to duty in the face of known danger—is not a part of our heritage from the jungle, but is rather its direct antithesis.

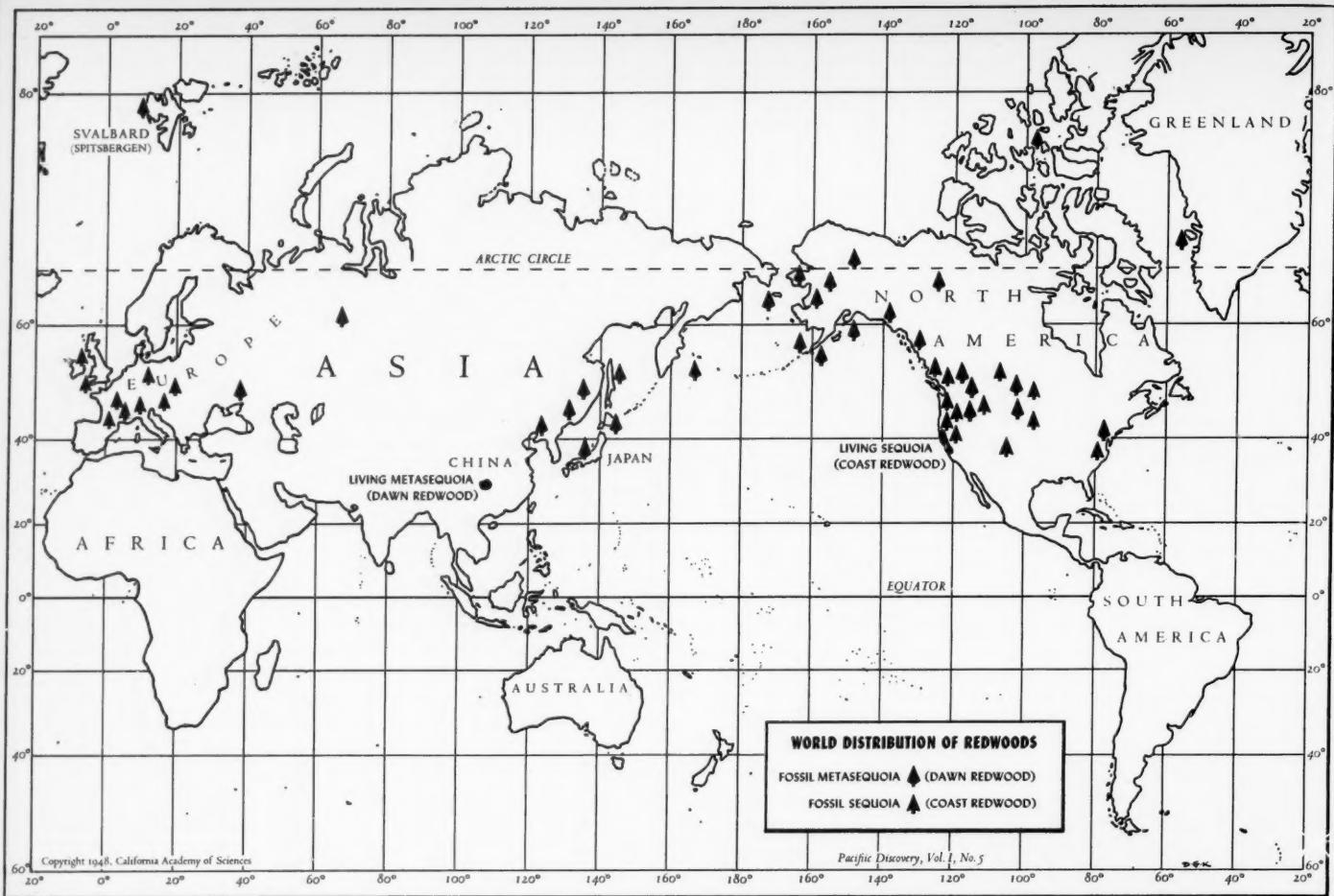
We sometimes impute courage or the lack of it to animals—boldness to the lion, for example, or timidity to the hare; but courage and cowardice have little meaning at subhuman levels. A lion is bold (if it is) because it has teeth and claws and the strength to use them. A hare is timid because its only chance of survival lies in flight. A stag at bay is no braver than a stag fleeing from the hounds. If it cannot escape, it will turn and fight. In either case the issue is individual survival.

Fear and anger are animal emotions, and the two are closely related. Each causes secretion of adrenalin into the blood, which raises the blood pressure, increases respiration, and releases stored-up energy for flight or combat; all of this in turn reinforces the original emotion. At the human level, fear and hate and the blind prejudice that so often leads to violence, may be termed thinking with one's adrenal glands.

Courage is wholly different from this. It requires going contrary to the dictates of one's glands, counter to the instinct of self-preservation. Courage always involves a moral element. It is based on the conviction that there are some things more important than personal safety, more important even than life.

The fact that a Swedish count and a French colonel have laid down their lives together in a land foreign to both, solely in the interest of peace, testifies to the courage and idealism that have gone into the making of the United Nations. History may well record Folke Bernadotte and André Serot as heroes of a new world order.

R.C.M.



RALPH W. CHANEY

Redwoods were widely distributed over the Northern Hemisphere during past ages, as shown by the fossil record (tree symbols on map). Redwoods live today only in California and southwestern Oregon, and in a small section of central China (black areas on map).

Redwoods Around the Pacific Basin

ON OCTOBER 10, 1769, members of the Portolá Expedition first sighted the redwoods of North America on the California coast near the present town of Watsonville. More than a century and three-quarters was to elapse before the discovery of redwoods in Asia.

During these years, fossil redwoods were found at many localities over the northern hemisphere. At first the leafy shoots, whose impressions were found in the rocks of France, were thought to be relatives of the yew and were called *Taxites*. With the discovery of fossil cones in Switzerland, the similarity of these fossils to the coast redwood, *Sequoia sempervirens*, of California, was noted

by the great Swiss paleobotanist, Oswald Heer. In the past century other fossil leaves, cones and wood of the redwood type have been found throughout most of the Northern Hemisphere, and all of them have been assigned to the genus *Sequoia*.

Those of us who are concerned with the history of Cenozoic plants, covering the latest sixty million years of geologic time, have long been aware that some of the fossils we have called *Sequoia* have cones different from those of our living coast redwood. These fossil cones are attached to elongate stalks on which there are no needles, and they have been considered a species distinct from the

immediate ancestors of the coast redwood. It was not until 1941 that the Japanese paleobotanist, Shigeru Miki, presented the evidence for referring cones of this type to a new genus, to which he gave the name *Metasequoia*. During the war we learned nothing about the progress of science in Japan, and it was not until the summer of 1948 that I had an opportunity to read Miki's paper. By that time much had happened.

The first major event was the visit of forester Tsang Wang to the village of Mo-tao-chi, more than a hundred miles northeast of Chungking, in Szechuan Province. Earlier botanists who had visited this part of China all appear to have traveled along the north side of the Yangtse River, and there is no record that anyone other than the villagers had ever seen what caught Wang's eye on the edge of Mo-tao-chi. Here in the midst of the rice-paddies rose an enormous tree, with leaves and cones unlike those of any tree he had previously observed.



ABOVE: Specimen branch of the dawn redwood, *Metasequoia glyptostroboides*, shows needles opposite on the twigs, and cones with naked stems. About $\frac{2}{3}$ natural size. (Photograph courtesy San Francisco Chronicle)

LEFT: Fossil twigs of *Metasequoia* from the John Day Basin of Oregon. These were imprinted in rock laid down 50 million years ago. About $\frac{2}{3}$ natural size. (Photograph courtesy Carnegie Institution of Washington)



All photographs by the author unless otherwise credited.

The Discovery Tree at Mo-tao-chi has a diameter of 64 inches above its buttress, a height of 98 feet. It rises among rice paddies in a valley which has been completely deforested.

In the small temple built beside the tree, candles and incense are burned while prayers are offered to the Tree-God. Many leaves on the tree are interpreted as a promise of ample crops.

COVER PICTURE: *The captain of the expedition's armed guard stands with the author at the base of the Discovery Tree.*

The second major event came about when Wang showed the specimens he had collected to Professor Wan-Chun Cheng of National Central University, and to Dr. Hsen-Hsu Hu of Fan Memorial Institute of Biology. Neither of these authorities on the trees of central China had ever heard of a tree with leaves and cones such as these. To them it was wholly new to the living flora of China and the rest of the world. But—and this is the remarkable part of their great contribution to science—they remembered that they had seen leaves and cones of the same sort on fossil specimens; the specimens from the great tree from Mo-tao-chi were an exact match for the

fossils which Miki had named *Metasequoia*. Fortunately they had read his paper in 1946, long before it reached the United States. They knew that the tree discovered by forester Wang was a *Metasequoia*.

The third event came about after Dr. Hu had written to me and to others in the United States regarding this remarkable discovery of a living redwood which had previously been known only as a fossil. Dr. E. D. Merrill, of the Arnold Arboretum of Harvard University, had sent funds for additional field work by the Chinese in central China; in 1947 trees of *Metasequoia* had been found growing at several other localities, and

many more specimens, including seeds, had been collected. Now, with some of these seeds on the table before me, I realized that a remarkable opportunity was presenting itself to see a forest of long ago, a forest whose principal member had been thought to be extinct for millions of years. In January of 1948, within a few minutes of my first view of these seeds, I was making active plans to visit central China. Dr. Milton Silverman, Science Writer for the *San Francisco Chronicle*, decided to go with me.

Six weeks later, after a flight to Chungking, a journey down the Yangtse to Wan Hsien, and a three-day trip inland over the rocky trails of Szechuan, there came the fourth and culminating event. We stood beneath the great tree growing on the eastern border of Mo-tao-chi, our hands upon its gray, red-flecked bark, our eyes uplifted to branches which rose nearly a hundred feet above. Here was a fossil come to life, a giant whose kind had persisted out of the past to tell us the story of the earth millions of years before man came to live upon it.

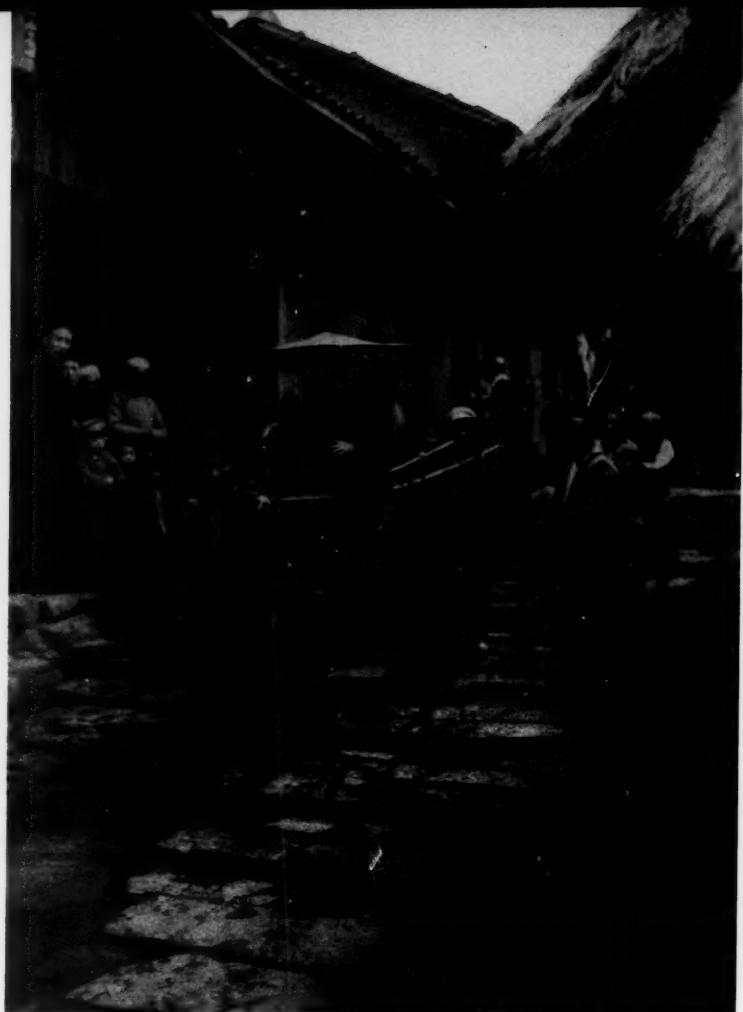
I shall mention only briefly the characters by which this *Metasequoia*, or dawn redwood, may be distinguished from *Sequoia*, the coast redwood, for they have been fully described elsewhere. Actually, no one will be faced with the problem of using these distinctions to separate *Metasequoia* and *Sequoia*—in the field, for several centuries at least, until the seedlings of dawn redwood we have planted in America reach a size comparable to our coast redwoods, or perhaps until someone has planted a coast redwood in central China. The most surprising of these characters is the deciduous habit of the dawn redwood; at the time of our visit in March its branches were bare of leaves, in striking contrast to the evergreen, or *sempervirens* habit of the coast redwood which holds its leaves for three or four years. There is a second means of telling these trees apart at a distance; the branches of the dawn redwood are ascending, while those of the coast redwood come out horizontally and are turned down at their tips. A third character has to do with the ovulate cones; they are attached



Our steamship down the Yangtse from Chungking made better time than the junks with their oars, sails, and tow-lines. At a low stage in March, the river rises over 50 feet in the summer, covering the gravel bars in the foreground and across the valley.

Leaving the Yangtse, we took the trail south from Wan Hsien, a large river city, on March 5, 1948. Baggage coolies followed our sedan chairs.

Carried by strong-backed, sure-footed coolies, sedan chairs are no more comfortable than they look—for passengers or bearers.



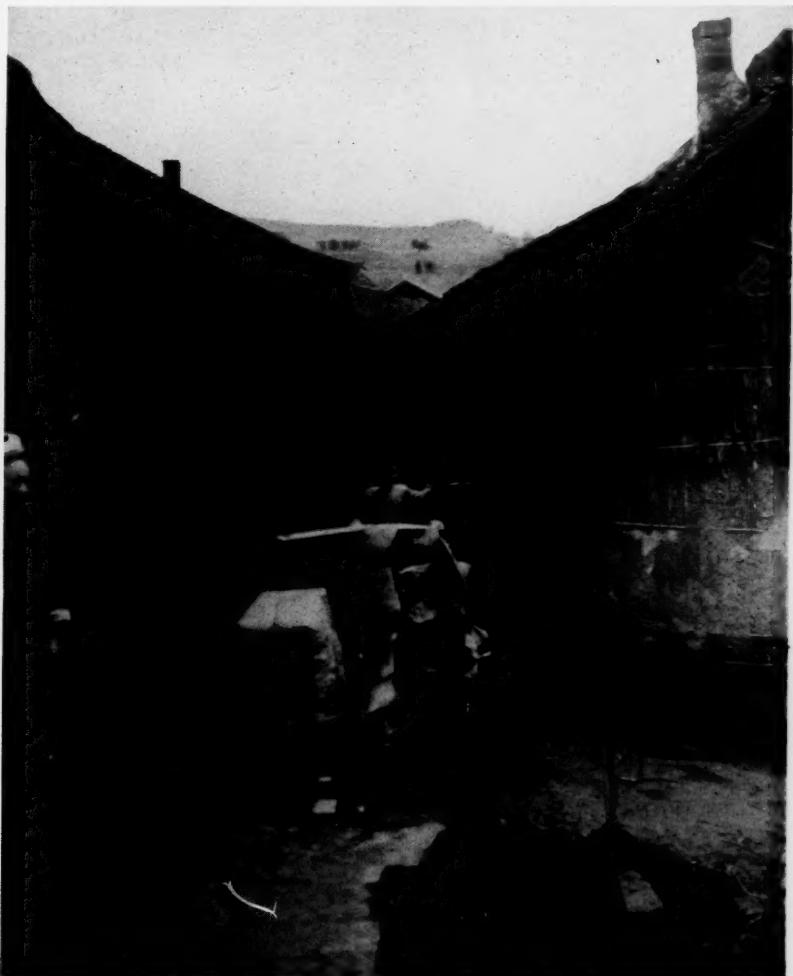
on long, naked stems, like those of certain American fossils and the ones described from Japan by Miki. A fourth character is the occurrence of the male cones on long spikes, which at the time of our visit were hanging from every branch. Wholly unlike the corresponding structures of *Sequoia*, these staminate aments show a marked resemblance to those of the swamp cypress, *Taxodium*, a related tree now living in the southern United States and in Mexico. Finally, the needles are arranged in pairs on the shoots, while those of the coast redwood, and of the swamp cypress as well, are alternately distributed. This character may be readily noted on fossil specimens as well as on the living plant. I have actually seen the leafy shoots of the latter only in herbarium specimens, for the trees of Szechuan and to the south were still bare at the time of my departure. The

leaves of *Metasequoia*, both living and fossil, are described by the botanist as decussate, that is, arranged in opposite pairs alternately crossing at right angles, like those of the cedars. Without going into further detail on the distinguishing characters of the dawn redwood, we may say that all four of the above mentioned features of leaves and cones may be equally well recognized in fossil specimens. Re-examining the large collections of fossil redwoods in our collections at the University of California, the California Academy of Sciences, and the United States National Museum in Washington, I had come to the conclusion that most of the specimens we have been calling *Sequoia*, not only in North America but in Asia as well, are actually *Metasequoia*. It had been a case of mistaken identity. In my study of the forests of the past, I had recognized abundant

fossils which I believed were the ancestors of *Sequoia*; now I found they were in many ways unlike it, and were identical with *Metasequoia*, the dawn redwood of China. Clearly some revisions were in order.

Many of the fossil floras of the western United States, collected in the John Day Basin of Oregon, the lake beds of the Spokane area, the foothills of the Sierra Nevada in California, and from various localities in Nevada, have a temperate aspect. Their fossil leaves are of medium size and thickness, and they appear to have been deciduous. Among the common trees in these floras are the birch (*Betula*), the chestnut (*Castanea*), the sweet gum (*Liquidambar*), the oak (*Quercus*), the beech (*Fagus*), and the katsura (*Cercidiphyllum*). The last of these is now confined to Asia, but all the rest are common members of the forests still living at middle latitudes in North America, and all of them are to be found in China and Japan. These temperate floras of the past are referred to the Miocene epoch, some fifteen to thirty million years

ago, and to the Oligocene epoch which preceded it by some ten million years. My studies, and those of other paleobotanists, have shown that this same temperate forest, made up of many trees which we commonly call the hardwoods, lived still farther north during earlier geologic time. In fact it appears to have had its origin at high northern latitudes during the Cretaceous period, about one hundred million years ago at the end of the Age of Dinosaurs, and at the beginning of the Tertiary period in the Eocene epoch, which came to a close some forty million years ago. From Greenland, Iceland, Spitzbergen, northern Siberia, Alaska, and the arctic islands north of North America, collections of fossil plants show this same aggregation of birch, oak, chestnut and katsura leaves. Always associated with this group of plants, which because of its development at the north during the Tertiary period has been named the Arcto-Tertiary Flora, we find the remains of redwoods, leafy shoots and cones. It had been rather difficult to explain the existence of redwoods of the Se-



The narrow, stone-paved trail took us through towns whose streets were barely wide enough for our baggage coolies.



On our trail to the south we took many of our meals at inns which, like this one, open onto the path with no doors. They are patronized by baggage coolies who provide the only transport in a land without roads.

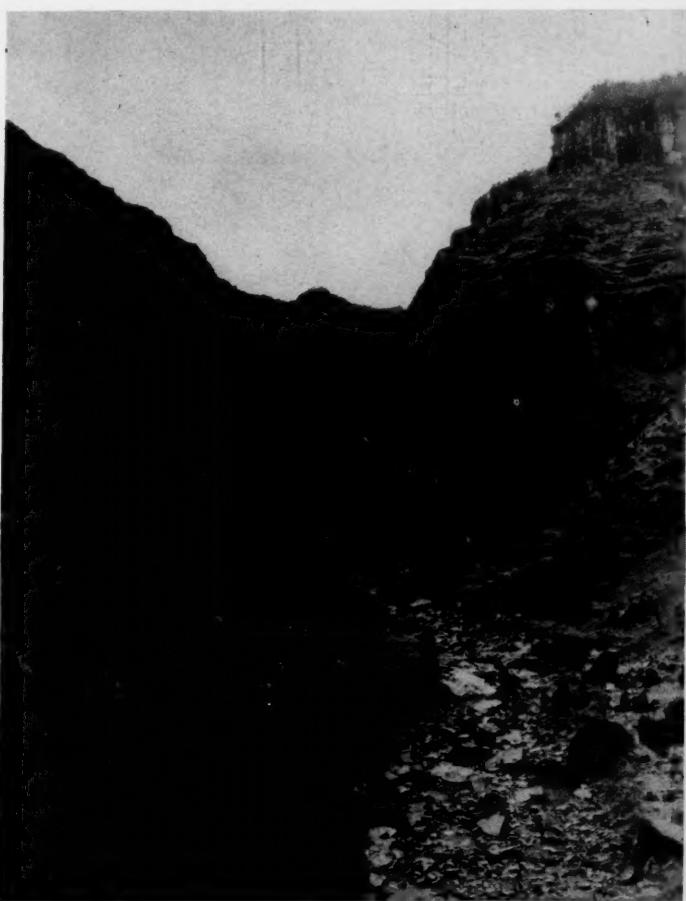
Turbans are worn by most of the people in this part of China.



quoia type in forests which ranged within eight degrees of the North Pole, for modern trees of this genus, with their evergreen habit, do not thrive in regions of severe winters. But now the emphasis of the whole problem has changed. Instead of the coast redwood, *Sequoia*, the dawn redwood, *Metasequoia*, ranged over arctic latitudes during the past, and it had a deciduous habit which was better suited to a long winter with no sunshine. Many meteorologists and geologists believe that during Eocene time the climate of the earth was much milder than it is today. The polar ice-caps of our day seem not to have been in existence, and currents of warm water may have greatly lessened the coldness of the arctic winters. Even under these conditions more favorable for forest growth, the winter months brought a long arctic night adverse to plant activity and growth. At this season all of the trees, including the dawn redwood, shed their leaves and entered into a period of dormancy like that with which we are familiar today in regions with cold winters.

Gradually the climate of the earth has changed. The mild winters in the far north gave place to seasons of longer and heavier frost. Mile by mile through the ages, the Arcto-Tertiary Flora migrated southward. The trees themselves could not migrate, but their ranges were restricted at the north and extended to the south. It required perhaps ten million years for the forest of dawn redwoods, birches, chestnuts and oaks to move from Alaska down into Oregon and California, from Siberia to Manchuria. We have the fossil record of their presence there, on both sides of the Pacific, and of their continued movement southward as late as Miocene time. Then conditions began to change drastically in western North America. From a regime of summer rainfall, which is favorable to deciduous trees, there came the dry summers and winter rains which now characterize so much of the Pacific Coast of the United States. Many of the members of the Arcto-Tertiary Flora could not survive in this altered environment; the dawn redwood and katsura disappeared from North America at the end of the Miocene; the chestnut and beech no longer live in western America, though they are numerous in the eastern United States where the summers are still humid. In Asia too, the climatic trend has greatly limited the range of some members of the Arcto-Tertiary Flora. The dawn redwood has disappeared from Manchuria and

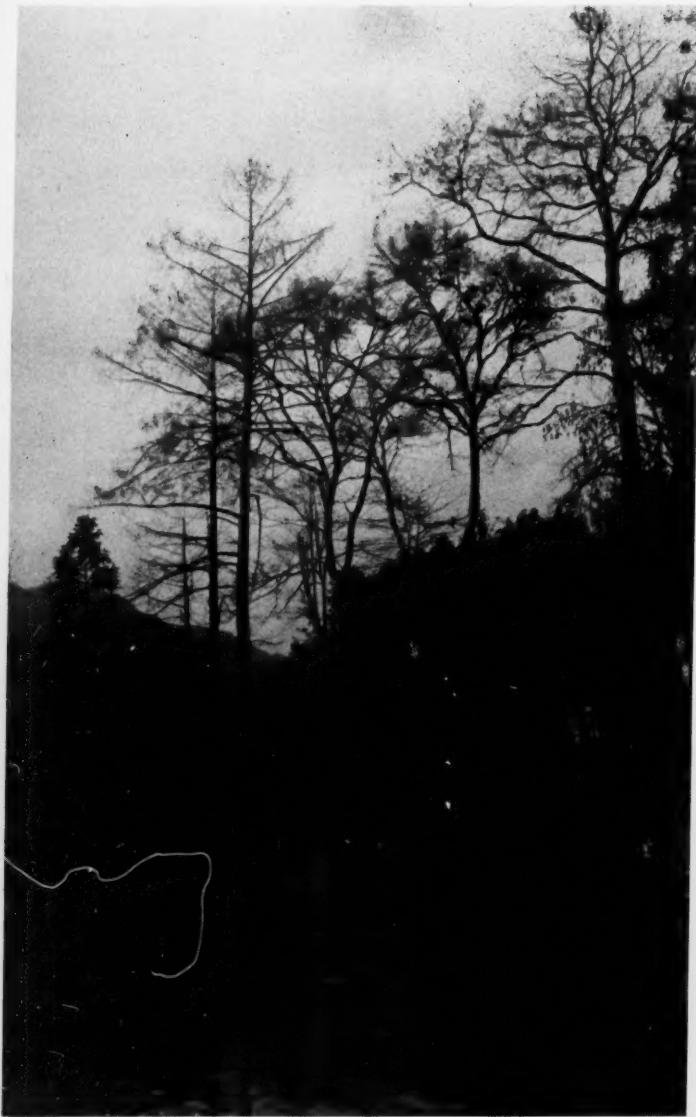
Japan, where it was once common. The only place where it is known to exist is in the Red Basin of Szechuan and adjacent Hupeh, where surrounding mountain ranges have protected the deep interior valleys from extremes of temperature and



High cliffs of red sandstone and shale rise in the valley of the Mo-tao-chi River, and here the trail is steep and rocky. There is a marked resemblance to parts of our own Southwest.

rainfall deficiency which characterize adjacent parts of China. *Metasequoia* survives in this limited area because only here there has remained an unchanged segment of the climate of the past.

Much of this I already had considered as I journeyed westward across the Pacific and into China. When I stood beside the huge tree at Mo-tao-chi, at the end of our third day of travel

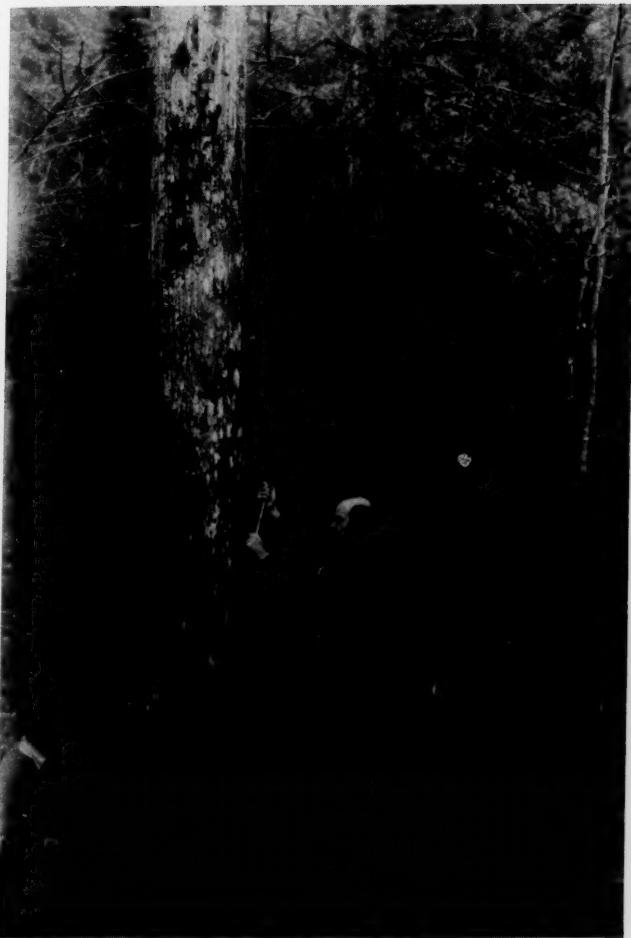


ABOVE: The three straight trees to left are dawn redwoods. Still farther left is the Chinese fir (*Cunninghamia*); in the picture's right are chestnut trees and bamboo.

RIGHT: *Metasequoia* always grows in wet places along the valleys. This tree is three feet in diameter and about 60 feet tall. In March it had no leaves on its large, up-turned branches.

on foot across the valleys and mountain ranges of Szechuan, I realized that its surroundings were not suited to a study of its original environment and associates, for it was growing in a cultivated valley from which all of the original forest had been wholly removed. So we continued on for two more days, trying days with cold fogs in the mountains, almost constant rains, and with inadequate accommodations for foreigners. Finally at Shui-hsa-pa, some 115 miles south of Wan Hsien and across a province boundary into Hu-peh, we found small groves of dawn redwoods in ravines, associated with deciduous hardwoods. It was these trees which I had crossed the Pacific and much of China to see, so that I might recon-





LEFT: Dr. Silverman uses an increment borer to take out a core from a dawn redwood with a diameter of 21 inches. A ring-count showed its age to be approximately 60 years.

BETWEEN: Headman Wu of the village of Shui-hsa-pa stands beside the trees of the left-hand picture (opposite page) with his three children. The youngest seems not fully convinced that the strange-looking man with the box on three legs has good intentions. No foreigner had ever before visited this village.



struct and visualize the forests of ages past. And I was not disappointed. Growing beside the dawn redwoods in the valley at Shui-hsa-pa, at an altitude of about 4,000 feet, were birches, chestnuts, sweet gums, beeches, oaks, and at least one large katsura. The Arcto-Tertiary Flora was growing there before me, with essentially the same membership as the group which had its origin to the north millions of years before, and which had migrated southward down both sides of the Pacific. Forests living elsewhere at middle latitudes today include many hardwood members of the Arcto-Tertiary Flora. But these valleys in central China are the only place where the dawn redwood, *Metasequoia*, is known to have survived with them.

We may wonder how long this tree, whose history goes back for a hundred million years at least, will continue to live in these remote valleys of central China. This is a land of need; fuel and timbers are scarce; land must be cleared for agriculture. Just before our arrival, two of the finest trees at Shui-hsa-pa had been cut down. Others will follow, unless—

It is gratifying to record the action being taken by the Chinese to meet this problem of conserving one of the most beautiful and interesting trees

in the world. A *Metasequoia* Conservation Committee has been organized, whose membership includes several of the foremost statesmen and scholars of China. Like the Save-the-Redwoods League, under whose auspices my trip was made, this Committee is seeking to preserve some of the finest groves for all time. To this committee go the best wishes of all Americans, especially those of us who may look out across the Pacific, knowing that the scientific problems and the future needs of Asia are essentially the same as our own.

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He watches them GROW

WELDON D. WOODSON

Charles A. Hewitt of Buena Park, California, strokes the chin of a giant Galápagos tortoise. These holdovers from the Age of Reptiles were long believed to grow very slowly and so, if large, to number their years perhaps in centuries. Raising them in his back yard, Hewitt has observed that they increase in size very rapidly—at least while young. Elder of these two tortoises is a mere 12-year-old. (Photograph by Keith Boyd)



IF YOU WISH to get some firsthand data on how fast certain species of tortoises, snakes, lizards, and alligators grow, consult Charles A. Hewitt of Buena Park, California. Not that such information would help you to pay your income tax, but it is nice to know, especially so you can refute the next person who blandly asserts, for instance, that it takes a century for the Galápagos tortoise to attain its huge size. To this, you can say "Bunk!" Hewitt has watched them grow up into veritable giants right in his own back yard.

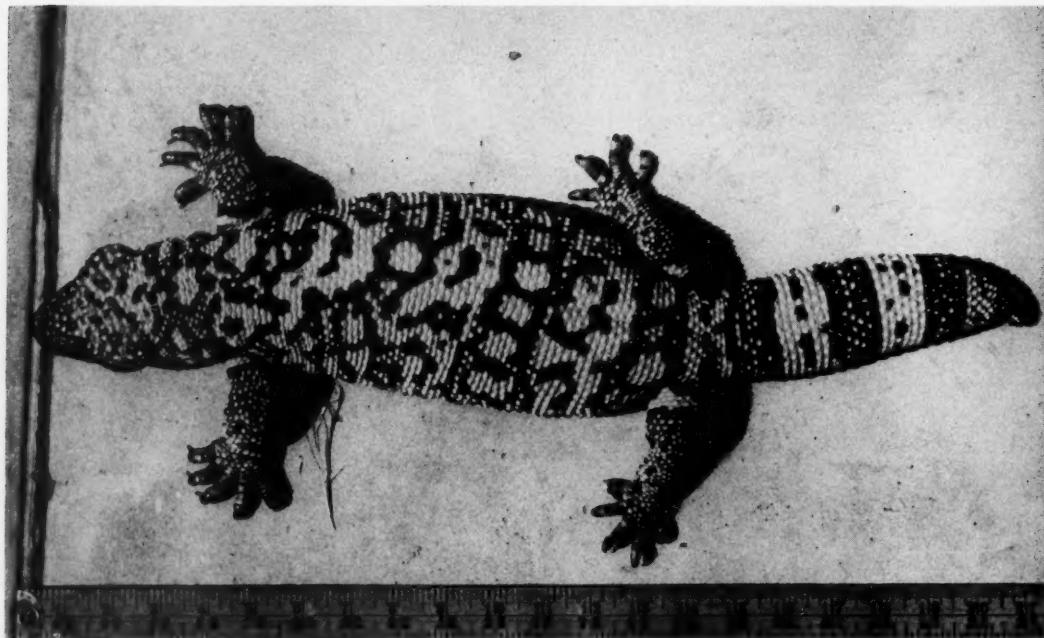
At one time, however, he knew as little about reptiles as the average man. Then, some years ago, an incident occurred that started him on the road to being a herpetologist. On the pier at Long Beach one day he was watching one of the several snake shows. For the finale the performer displayed a big king snake, then, dramatically, took off his large hat and there reposed in it three small king snakes. As many boys eagerly bought them for twenty-five cents each.

Thinking it over, Hewitt decided that he, too, would like a snake. But it was too late. The exhibitor explained that he had sold out. By chance Hewitt came across a boy who had bought a garter

snake the previous day, and offered him a quarter for it. The boy refused, stubbornly, to part with his snake. Hewitt raised his offer to fifty cents—pointing out that, since the boy lived in the community, he could next day buy two with the money. That sealed the bargain.

During those days Hewitt lived in Whittier, his friends knowing him as a chemist. Chemist, indeed, he is still, by profession; but his avocation is the raising of reptiles. That garter snake was the beginning; he added bull snakes, an indigo snake, a few boas from Mexico, Central America, and South America, and—his greatest prize—an eighteen-foot African python. He has also kept rattlesnakes and copperheads.

Only once has he been bitten. A copperhead struck him on the ring finger. One fang hit his ring, the other slightly pierced the flesh. He applied first-aid and went to work next morning. He contends that it was not the snake's fault, for he handled it with undue carelessness and deserved the bite. Regardless of whether the reptile is venomous or non-venomous, he treats it with consideration, just as others show tenderness to a cherished house cat or dog.



Largest known Arizona Gila monster? If you have a bigger one, Charles A. Hewitt would like to compare notes with you. His is shown 2/7 natural size. (Photograph by Keith Boyd)

With the increase in his knowledge of reptiles, Hewitt was called upon to give lectures to schools, to this or that club, and to zoölogical societies. Once he was asked to deliver a lecture to a group of zoölogy students at Whittier College. It was during the cold of the winter, however, and he protested taking his tropical animals from their warm quarters. That didn't discourage the professor in charge of the class. He brought the students to Hewitt's home, and there, in a tiny room with jungle creatures at their very elbows, they listened to a discourse on natural history.

His—or more correctly his wife's—rarest experience happened in 1943 in his home in Buena Park. His snakes occupied a room in the house, and at times the non-poisonous ones, including the eighteen-foot python, were permitted to crawl about loose. The poisonous ones, of course, were safely sheltered in cages, but with glass doors so they might be seen. As for the other members of his collection, some, such as a large alligator and the tortoises, were in their enclosures in the back yard.

Upon this occasion, Hewitt was at work in his office. A caravan of trucks loaded with soldiers came to a stop in the street opposite his home—

motor trouble. The G.I.'s got word of Hewitt's menagerie, and the lieutenant asked Mrs. Hewitt if the boys might look at the animals. She gladly consented—with the thought that they would limit their observations to the ones in the yard. When they had completed their tour there, however, someone was reminded that the choice ones were inside the house. So, single file, the boys marched in the back door, scrutinized the reptilian exhibit, and found their way out through the front door. There must have been at least five or six hundred of them, Mrs. Hewitt estimates. At least it seemed that many to her.

While pleased at this opportunity to furnish enjoyment to the boys in the service, Hewitt does not welcome the ordinary visitor who looks upon his creatures merely as objects of curiosity. On the other hand, he is most gracious to those sincerely appreciative of natural history. He is not a showman, but a scientist. He is a member of the American Society of Ichthyologists and Herpetologists and also the Herpetologists' League. He corresponds with many of the leading naturalists of the country, and they send him complimentary copies of their books and technical papers. Meanwhile he has been noting down his own observa-

tions, which, at a future date, he intends to make public.

His most significant contribution will be his findings on the growth rate of reptiles. One of the animals he has studied is the Gila monster. He first procured a specimen in 1937, then one in 1938, and another in 1942. He controls the temperature in their cages to prevent them from hibernating. Once a week the year round he feeds each a beaten hen's egg. His conclusion is that they grow slowly, his showing an average yearly increase in length of about .47 inch. Of the three, nevertheless, one grew exceptionally large, the latest measurements showing it to be 21.5 inches long, with a weight of four pounds.

As far as he knows, this is the largest Gila monster (*Heloderma suspectum*) now in captivity. But, unlike the barker at a circus who, despite facts to the contrary, continues to cry his exhibit the biggest of its kind, he is anxious to know of any other owners of Gila monsters whose charges exceed his in length or, for that matter, even approach it.

Of special interest are his investigations of the

Galápagos tortoises, whose original habitat is the islands of that name off the coast of Ecuador. Not so long ago, tortoises were plentiful in the Galápagos, many individuals weighing as much as 300 pounds. Hunters slaughtered them by the thousands, chiefly for their fat—and today we can see them only in zoos and museums, or in private reptile collections. For his purposes Hewitt secured a dozen young ones. He housed them in roomy outdoor pens, providing them with an arbor for shade, for they will die if exposed too long to the direct rays of the sun.

At the beginning, he made both weight and shell measurement records every month. He was aware that it used to be thought it took them hundreds of years to reach a large size. On the other hand, he found they grew quite rapidly while small. They probably never stop growing, although, to be sure, the growth rate slows up as they get larger. To give an indication of his own figures, Hewitt recorded an increase in weight of a small specimen of over 400 per cent in a year's time. Truly that tortoise was no slow grower.



Galápagos tortoises, although they like to bask in sunshine, appear to suffer from too-long exposure to it. Hewitt provides his specimens with an arbor. (Photograph by Keith Boyd)

EARLE G. LINSLEY

The Sky in Early Winter

CONTINUING OUR SERIES begun in the first issue (January-February 1948) we introduce our readers to a chart of the November evening sky. Most notable is the absence of bright stars in this great area of the sky, in sharp contrast with the bright winter stars that will follow. With the exception of planet Jupiter low in the west (not shown on the chart), you will be guided in picking out the constellations by faint stars and limited further by a full moon in the middle of the month.

Constellations and Myths

Nevertheless, facing south it is easy to pick out Pegasus, a portion of which when including one star from Andromeda is called the Great Square. Interest aroused by the name Pegasus may turn you to the legends of the star groups on the chart. Such legends, not real astronomy, are too long to recount here. The myth of Pegasus, the famous winged horse which sprang from the blood of the Medusa after Perseus had sliced off her head, also introduces Perseus, Andromeda, her father, Cepheus, and her mother, Cassiopeia, Queen of Ethiopia. All of this family group have constellations named for them in this part of the sky. The difficulty of finding these characters is illustrated by Pegasus; his form must be traced upside down with his forefeet projected high in the heavens. Head, neck, wings, and forefeet only are shown in the ancient drawings.

"Special Features"

Chief object of interest in Andromeda is the "Great Nebula," now known to be a galaxy. Without a telescope it appears a fuzzy patch of light just visible through the hazy atmosphere of our cities but easily identified at sea or in the mountains. Probably no astronomical picture is so frequently published as photographs of this object. Taken through great telescopes, they reveal features observers cannot see. Let imagination be stirred, however, as you try to realize that this object is a spiral galaxy of countless millions of stars so far away that it takes their light about 800,000 years to reach your eye.

Perseus offers two interesting objects easily observed without a telescope: one, the variable star *Algol*, Beta Persei, known to the Arabs as the "Demon

Star." It fluctuates regularly in brightness at intervals of two days, 20 hours, and 48 minutes; in 4.5 hours it decreases one magnitude and in 20 minutes brightens again. Watching this phenomenon you are seeing the eclipse of a great sun by one less luminous.

The second, between the chain of stars outlining Perseus and the group of Cassiopeia, is the beautiful *double cluster* of Perseus, visible without a telescope and a reward for patient searching.

Fomalhaut (Fo'-mal-o) in Piscis Australis or the Southern Fish, is the most southerly of bright stars visible to our northern states. Only bright star in that area, it is easy to spot. It is the sole guide to the location of its constellation for the other stars are faint.

Deneb in Cygnus deserves your respect. It is headed our way at about two miles per second. It may be that in actual luminosity it outshines our sun 10,000 times. Cygnus, the Swan or Northern Cross, has Deneb as its brightest star, making the top of the cross. This group lies almost wholly in the Milky Way. The star at the foot of the cross, *Albireo* or Beta Cygni, is considered the finest colored double in the sky. Contrasting blue and gold make it truly a California star.

Planets

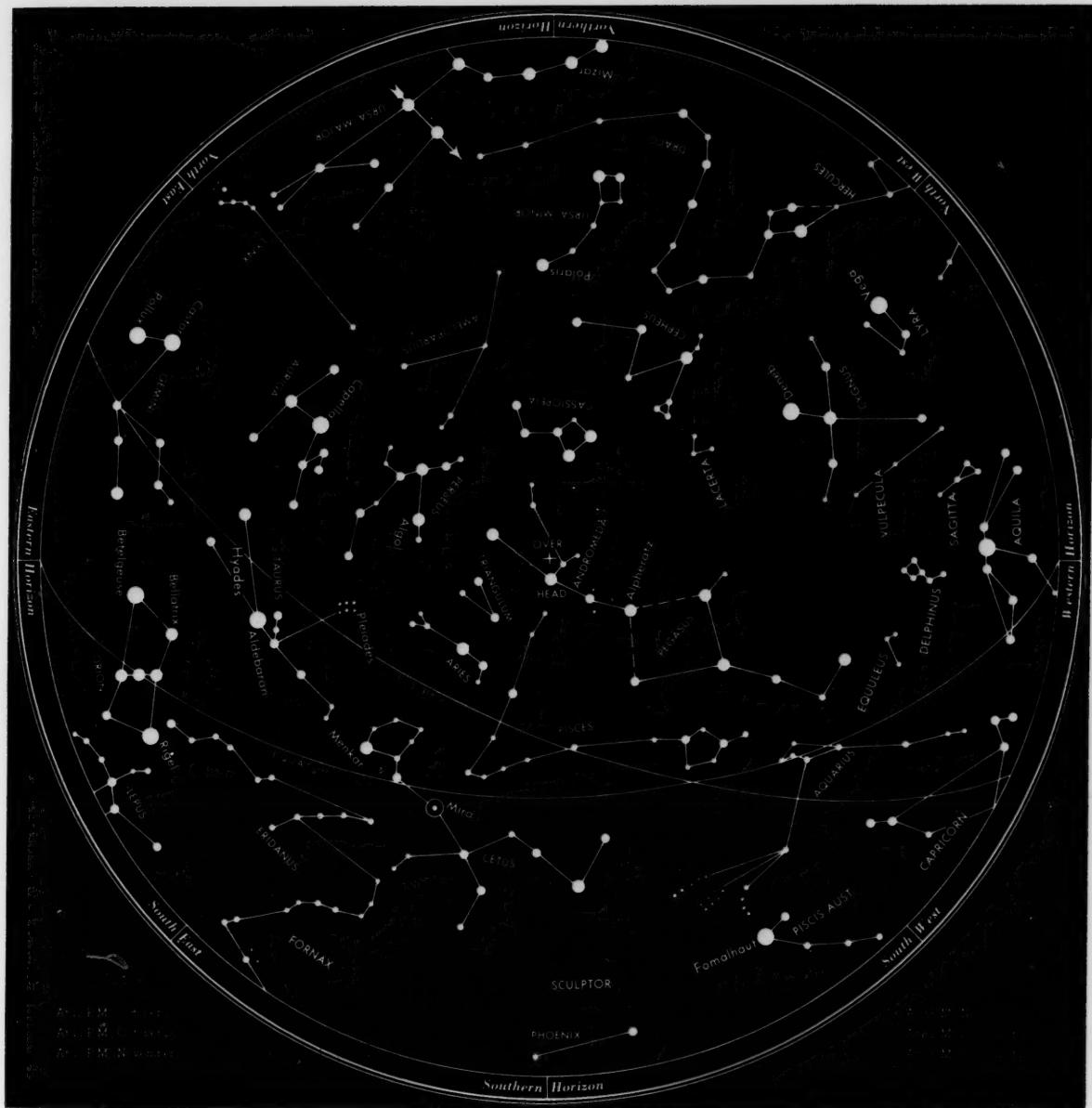
Our chart does not show the planets. *Mercury* is a morning object and may be found rising ahead of the sun early in the month. Later it is too near the sun to be seen. *Venus* is brilliant in the morning sky. *Mars* is too low in the southwest for satisfactory observation. *Jupiter*, still brilliant in the western evening sky, may be seen for a few hours after sunset. *Saturn*, rising about midnight, may be located near Regulus in Leo.

The total eclipse of the sun on November 1 will not be seen in America, being a phenomenon for observers far south in the Southern Hemisphere.

Meteors in November

"What makes a star fall?" This question has been put to the author by scores of eager children through the years at Chabot Observatory. Standing on their porches in August and November, they have seen what appear to be stars flashing across the sky. Stars do not fall. These objects are *meteors*, bits of iron or stone which sweep in orbits around the sun. As the earth crosses their paths many are swept into its atmosphere. We see them, made luminous by friction, only a few miles away but against the background of the stars. Since the earth plows into two meteor swarms in November, the possible displays add much of interest to that month's sky watching.

These two swarms, named after the constellations against which they appear, are the *Leonids* (from Leo) and the *Andromedids* (from Andromeda). Watch for



the Leonids on November 14 and 15. They are very swift, with deep bluish color. The constellation rises later than the time of our chart. The meteors are seen best after midnight; this year, however, a full moon will dim our view of them.

Quickly passing through the Leonids, the earth by November 17 is in the Andromedids. Because this swarm is slower-moving the meteors may be seen for about ten evenings. They show short trails and a yellowish color.

But there might be at any moment a brilliant flash, brighter than a visible star or planet—and you are wit-

nessing a near meteor burning up or exploding, with the possibility that fragments may reach the earth and be recovered. These fragments are *meteorites*. Such a one, without doubt, was the great Goose Lake meteorite which fell long ago in northeastern California, weighing over 2,500 pounds. A replica of it is exhibited at the California Academy of Sciences. Such suddenly appearing, erratic meteors should be observed against the constellations so their paths can be charted, and the information reported immediately in writing to this department of *PD* at the Academy. This may help locate a fallen meteorite on the ground.



A Reptile Hunter's AUSTRALIA

JOSEPH R. SLEVIN

"Mountain devil" and "thorny devil" are among names Australians call this lizard, *Moloch horridus*. About twice life size. (Photograph by Ione B. Stephens)

THE END OF AUGUST 1947 found me boarding the clipper *Oriental* of the Pan American World Airways on my third voyage to Australia to collect reptiles and amphibians for the California Academy of Sciences. Quite a contrast it was, I must admit, to my former voyages: the first in 1929 on board the old Oceanic liner *Ventura* with all the excitement of a passenger steamer sailing—longshoremen loading the last of the mail while others stood by for orders to let go the lines, the ship finally backing out into the stream with paper ribbons parting as she gained momentum. My second voyage on the Swedish freighter *Sydic*—whose sailing date was postponed from day to day and from hour to hour—was without excitement, the ship finally shoving off about ten o'clock at night to be caught in a heavy fog outside the Golden Gate and cruising about for an hour or more trying to pick up the pilot boat in order to discharge the pilot. Once under way, however, the voyage was twenty-six days of real enjoyment for one who loves the ocean.

We never sighted land until the ship passed close to Walpole Island off the New Caledonian coast, nor a vessel, until the lookout picked up the Brisbane pilot boat.

Now for my third voyage. In a comfortable waiting room instead of a cold and windy dock and in the hands of a thoroughly organized and efficient service I awaited the clipper's take-off time. At last the instructions came over the loudspeaker: "Passengers for Noumea, Fiji, and Australia please board the clipper *Oriental* at Gate Number—." Passengers were checked off and assigned to their respective seats; lights flashed on "NO SMOKING—FASTEN SAFETY BELTS"—and we were off promptly on the minute. As the plane took off I could hardly realize I was to lunch in Honolulu—almost breakfast there, in fact, as the clipper passed close by Diamond Head and landed at the airport long before the noon hour.

In a tropical garden setting I was the luncheon guest of Dr. and Mrs. F. X. Williams—the Doctor was

ROADS TO DISCOVERY

my companion on the Academy expedition to the Galápagos Islands some forty years ago. The clipper took off from Honolulu about mid-afternoon, made a brief midnight stop at Canton Island for overhauling and servicing, and put down in Fiji early in the morning. Here, Mr. E. W. Gifford of the University of California, engaged in anthropological research in Fiji, and Mrs. Gifford met me at the airport and took me to breakfast.

Somewhat breathless from the speed of air travel I lunched at the Noumea airport, realizing with a thrill that in a very few hours I would be greeting my Australian friends once more. And just as darkness approached I could see some patches of the Great Barrier Reef far below, but it was just too late for really enjoying an aerial view of this, one of the great natural features of the earth, so ably described by Roughley in his *Wonders of the Great Barrier Reef*.

In a few minutes the lights of Sydney appeared and as the plane lost altitude we could easily see we were coming to a great metropolis. As we made the long glide down and the barely perceptible contact with the runway, I marveled again at the great skill with which these transoceanic giants are handled.

Australia again—and I felt perfectly at home for there to meet me was my old and valued friend Mr. J. R. Kinghorn, Assistant Director of the Australian Museum, who had a great deal to do with the smooth running of my operations "down under."

As any expedition needs much preparation before cutting free of a supply base the help of a sister institution is all but indispensable, especially in a foreign land. Everything possible was planned before I left America; the Director of the Australian Museum, Dr. Walkom, offered me its facilities and himself attended to many incidentals that cropped up along my way.

Unless he is going after the large crocodiles, py-

thons, and other reptilian giants, the herpetologist's collecting equipment need not be elaborate; a .22 caliber shot pistol, hand ax, spot light, a small jar of alcohol, and a few tight bags are sufficient for most work. The chief difficulty is with the tanks of preservative. These were filled and stored for me at the Australian Museum and on receipt of a wire or letter were at once dispatched as ordered, so that fresh tanks were always waiting for me at my next collecting station. As I filled tanks with specimens I sent them back to the Museum for storage until my return.

To an old friend I owe my original introduction to Australia. A letter from Mr. Andrew Chaffey to Mr. James Burns of Sydney opened the continent to me. To Mr. Burns and the many other "new" friends in Australia I owe three most successful hunting seasons which added over 6,000 reptiles and amphibians to the collections of the California Academy of Sciences. Wherever I went in that far-off land, friendly people received me with a warmth and hospitality unequalled.

Australia is estimated to have assumed its present continental outline somewhere between one and two million years ago. In its rocks are ancient fossils, and living on it today are some of the world's most primitive animals, such as the platypus and spiny anteater, and some of its queerest reptiles, such as the frilled lizard and the moloch. For beauty, color, or strangeness it would be hard to match Australia's birds—the king parrot, the lyre bird with its graceful plumes, the emu, the black swan. For an insight into this wonderful fauna read Cayley's *A Guide to the Birds of Australia*, Leach's *An Australian Bird Book*, Troughton's *Furred Animals of Australia*, Burrell's *The Platypus*.

Tourists make for points of scenic or historic interest, but a reptile hunter must go where geography and terrain indicate numbers and varieties of reptiles. Faced with an all-too-short season and great dis-

The homestead, Keera station, New South Wales. Headquarters of Mr. Gordon Munro's big cattle and sheep station—"ranch" it would be called in the American west. With its gum trees (eucalyptus) this could pass for a spot in California.

(Photograph by the author)



tances, he must make the most of his time by careful planning before he takes to the field. With a map and weather information he must plot his travels from point to point in a way that will take best advantage of local conditions—hoping always for ideal weather and no collecting time lost.



The kangaroo, still common in bands, is typical of Australia's sheep country. There are several species scattered over the continent. (Photograph courtesy of J. R. Kinghorn)

Spreading a map of Queensland on the table before my friend Mr. Burns in Sydney, I put my finger on a spot I thought far enough inland to be away from the more thickly settled coastal areas and about as far north as I could get with my limited pocketbook. My finger happened to hit close to the town of Capella about 23° S. latitude and 148° E. longitude. "Ah," said my friend, "that's the location of the Retro sheep station. I'll notify the manager you are coming." From

this station I started my field work which in the course of three seasons took me through grasslands, deserts, and forests to the coral islets off the western coast.

My journey from Sydney to Capella was an experience. The little narrow-gauge railways in the back country are not what one would call de luxe, and I soon found ventilation was not much of a problem for when the coach listed from side to side on a none too well ballasted track its seams opened up enough to let plenty of fresh air blow through the compartment even though the windows were closed to keep out the cold winds sweeping over the grasslands. It was strictly sheep country I was traveling through.

Another point of difference with American train travel was that the passenger had to use his own resources to determine when he had reached his station and get himself off; I sat up all night with a timetable and watch keeping a lookout for Capella, afraid I would doze off and miss it. Day had not quite dawned when I heard the locomotive whistle and, checking with my watch, figured it must be time for my stop. Sticking my head out the window I saw a light ahead. The train slowing down for the station, I could see a man on the platform waving a lantern, and yelled to him as we ground to a halt: "Is this Capella?" When he called back, "Aye, bloke, this is the place!" I and my baggage tumbled off in haste.

Setting out for Queensland I had had visions of semi-tropics and warm humid weather, but Capella might have been within the Arctic Circle for the way its icy winds knifed through my khakis. But I was soon in a car driven by Mr. William Robinson, assistant manager of the Retro sheep station, who was taking me to my first hunting ground. On my second trip to Australia this same gentleman invited me to visit him at Talafa station, Queensland; and on my third trip he was my host at Bundy station, New South Wales.

Retro's manager, Mr. P. C. Allan, proved a delightful host. Mrs. Allan was particularly interested in whatever reptiles were discovered about the station, and was in the habit of sending everything she was unfamiliar with to the Queensland Museum for identification. Coming in from a hunt, it was a pleasure to have someone so actively interested in my work greet me and look over the bag to see what I had captured.

There is a daily sameness to station life in Australia. Tea is usually served at 6 a.m. before one gets up, again at breakfast, at ten-thirty, noon, three-thirty, at dinner, and again in the evening before turning in. From all accounts the 6 a.m. cup is the day's best but, personally, I failed to appreciate that bit of service. As soon as I found out what was going to happen every morning, I made it known I would dispense with the courtesy. A cup of good old State-side coffee would have had me on my feet after it,

but like every Yankee in Australia I learned not to raise my hopes when I saw the sign "American Coffee"—because that's not what it means. It always reminded me of an American newspaper woman's remark that "Australian coffee is more deadly than its snakes and they're the deadliest in the world." Suffering is mutual, however, for when our Australian friends ask for tea in America they get, as one gentleman expressed it, "A dirty little bag of tea floating about in a cup of warm water!"

Except for tea, Australians of the sheep and cattle country live much as many western Americans do. Station children learn to ride about as soon as to walk, and of course the stockmen—cowpunchers to us—are splendid riders. Large stations are really independent communities, with machine shops, blacksmith shops, garages, commissaries, even schools.

Looking over the country around Retro I thought at first I had made a bad choice—there was nothing to suggest it was the home of strange reptiles. This country seemed in no way different from many parts of California where I had hunted snakes and lizards—nothing unfamiliar about gum trees (eucalyptus to a Californian) and acacias; only the bottle tree—a grotesque creation which resembles a large jug with branches coming out of the top—gave one a feeling of the exotic.

Knowing it was a strange land, nevertheless, and wishing to see some of its animals, I took cover in a dry creek bed and waited for some "bush" life to show itself. It was not long before a large flock of white cockatoos discovering me set up such a commotion they must have put every animal within half a mile on the alert. Curiosity satisfied, they passed on, leaving the stillness of great open spaces. Soon I saw my first kangaroo in the wild; it moved slowly along grazing on choice bits of grass, unaware of me, yet every few moments standing erect and looking about to see that all was clear. Even at home these animals are timid and watchful, the slightest movement sending them off and out of sight. Hunted for its hide and continually chased by dogs, a kangaroo enjoys a life of uncertainty, to say the least.

It did not take me long to find reptiles abundant, after all, though to see a lizard sunning itself on a fence post was a novelty, to see a snake even more so. Gradually becoming acquainted with the habits of Australian reptiles, I learned that most of them stay under cover, and you have to dig for them. In the end, Retro proved exceptionally rich in reptile life, so rich, in fact, that I overstayed my allotted time.

It was at Retro I was first introduced to the great Australian ceremony of "boiling the billy." The various duties of the station—repairing fences, keeping gates in working order, cleaning water troughs—require long trips by cart or utility truck to the far ends of the property; this means a full day or more away

from the homestead. About ten-thirty in the mornings and three in the afternoons, the billy, which is nothing more than an ordinary tin bucket, is put into commission and enough tea is brewed for all hands. What satisfies an Australian we wouldn't recognize as tea in America. When it's good and dark, strong



Member of the cacao family, the bottle tree is related to coffee. In dry seasons pulp from its water-storing trunk is mixed with molasses and fed to cattle. (Photograph courtesy Mrs. P. C. Allan)

enough to tan a kangaroo hide, and begins to dissolve the spoon—tea is ready to serve.

Regretfully I left Retro and my kind friends, but an invitation to Coomooboolaroo (accent *la*), a cattle station, was taking me to wooded country eighty miles south.

En route to Duaringa, train stop for Coomooboolaroo station, I saw in daylight the country I had passed through at night on the way to Capella. It was hard

to believe what I now knew, that so much bird, animal, and reptile life inhabited such open, sparsely wooded country.

My watch-and-timetable routine got me safely off the train at Duaringa, where again I was met—this time by Mr. Barnard of Coomooboolaroo, who welcomed me to his station and told me alcohol tanks from Sydney had already arrived.

Coomooboolaroo is an aboriginal word meaning "two waters," the station so-named from two small lagoons at the rear of the homestead. I was now in heavily wooded country and another paradise for the reptile hunter, the old hollow logs, fallen trees, and debris on the forest floor giving cover to the python, the venomous brown snake, the bizarre frilled lizard with a Queen Elizabeth collar over the back of its neck, and the secretive geckos, those harmless nocturnal lizards which seem to be classed as deadly poisonous wherever they are found. A bird lover would be entranced at the sight of the black swans within a few yards of the house, the warblers and wrens of the thickets, and the gorgeously colored parrots which in the evening flock in large numbers to the water troughs for a drink before going to roost. A flock of king parrots with their green backs and crim-

son heads and breasts glistening in the late sun is a sight long to be remembered.

In a very short time I found that my host here was a real reptile hunter himself and knew just about every species of snake, lizard, and frog in the surrounding country as well as every bird and animal. Coomooboolaroo is the land of kangaroo, wallaby, wallaroo, dingo, and emu. The dingo or wild dog is a destructive animal, killing both cattle and sheep, and is hunted unmercifully.

I had been at Coomooboolaroo about a month and began to think of moving on so as not to wear out my welcome. Breaking the subject to my host, I was answered with: "Oh, my, no—you haven't got everything yet! There are several more places I'm going to take you." Reassured, I wired to Sydney for another tank of spirits, and enjoyed two profitable weeks more, visiting new territory with Mr. Barnard and adding new species to my collection. With tanks filled to capacity, I had to take leave of my friends at last in order to have time for the big country far to the west.

Rail to Sydney and a weekend at sea on the coastal steamer *Manunda* brought me to Melbourne, my tanks having preceded me as usual. In this southern city it was Mr. Ben Chaffey, brother of the gentleman whose letter had opened Australia to me, who welcomed me and arranged my next move. I told him I would like to get somewhere on the Murray River—I had not yet been close to any large stream—where I would doubtless meet with an entirely new fauna.

The Murray is Australia's largest river, and Ned's Corner is a sheep station on its banks. When I got there from Melbourne in company with its manager (via train to Mildura and station car to the homestead) I found it a drastic change from Coomooboolaroo. The country was suffering from severe drought and a dust storm lasting the better part of a day spread such a heavy blanket of red dust over the homestead it seemed a weird red fog, making it necessary to light lamps in midday and close all doors and windows. At one stage of the drought the banks of the Murray became littered with dead fish, 45,000 to the mile, according to an official estimate.

Such unfavorable conditions indicated a short stay, although I did get many desirable specimens, including the dreaded tiger snake. After a week, my tanks filled, I asked to be driven to the Adelaide train. "We'll drive all the way to Adelaide whenever you are ready," the manager insisted. It was 150 miles, but there was no denying this typical hospitality of the Australian bush.

In Adelaide I again boarded the *Manunda* and enjoyed a sea voyage to Perth. I was now clear across the continent, but still not a stranger in a strange land, at least not for long, for my friend in Sydney had notified Mr. Charles Craig of Perth to expect me. To Mr. Craig I owe my visit to the great gum forests and



The prickly lizard, *Amphibolurus barbatus*, is common all over Australia, abundant in Queensland and New South Wales. Its length is about 20 inches. (Photograph by the author)



Pelsart Island, elevation 6 feet, is treeless; firewood is brought from the mainland. Roof of recreation house catches rainwater which is stored in the large tanks. Fishermen occupy tents in the distance. Foreground is coral sand dune. (Photograph by the author)

all my activity in Western Australia during two seasons there.

The great forests at Nangabrook and Manjimup in the south of Western Australia are worth traveling far to see. Here trees tower over three hundred feet high, perhaps without a limb for sixty or seventy feet. Camping in these forests of eucalyptus is an experience.

At a surveyor's camp in the heart of the Nangabrook forest I was introduced to kangaroo tail soup, which to me, as I sat sipping it in the dim light of a smoky lantern, tasted better than anything the Waldorf-Astoria could have offered. The forests have their own peculiar species of kangaroo, and the boy who cooked for the surveyor, his two assistants, and me, spent his spare time hunting them, drying and selling the hides, and adding the tails to the larder for soup.

Bird and animal life was not abundant in the thick of the forest; the most striking bird was a large black cockatoo which kept high up in the tree tops. Of mammals the kangaroo was most in evidence; snakes were scarce, and lizards and frogs were numerous.

On my second trip to the west, pressed for time and with train travel difficult since the war, I took to the air—a day's trip from Sydney to Perth. Australia is air-minded when it comes to traveling; the planes are the best, airports excellent, and service all that

could be desired. Flying by day gave me a chance to see a lot of the country. Unfortunately the Nullarbor Plain, that vast open land between the Great Australian Bight and the Great Victoria Desert, which I was so anxious to see, was almost totally obscured by clouds beneath us. At rare intervals we caught glimpses of the transcontinental railroad on its three hundred-mile straightaway across the treeless Nullarbor, and I reflected on the difficulties of working this inviting region from the ground. Thinking of the specially equipped expedition it would require, I had to dismiss even the idea of ever exploring it. Darkness set in as we neared the western coast and landed; after twenty years I was in Perth once more.

Mrs. Craig and her daughter met me at the airport, to my surprise, and drove me to the hotel where they had secured accommodations for me—hard to get in any Australian city since the war.

Having been in the forests to the south on my first trip, my objective now was Houtmans Abrolhos, a group of tiny islands some forty miles off the coast at Geraldton, two hundred miles north of Perth. I took a bus to Geraldton by day in preference to a night on a train, spent the next night in that port city, and early in the morning boarded what might be called a motor-sampan for Pelsart Island, a small coral reef belonging to the southern group of the Abrolhos.



"Sleeper-cutters'" hut in the gum forest near Ulong, New South Wales. Gums cut for railroad ties furnish slabs of stringy bark to shelter the cutters, crudely but snugly. Wire leads to a fire ranger's telephone. (Photograph by the author)

Pelsart is about six miles long by a hundred yards to three-fourths of a mile at its widest point. Only an experienced skipper such as ours could have brought a boat to anchorage through its channels and treacherous shoals.

Famous in the early days as a graveyard of ships, the island's shores are still wreck-laden. Still in evidence are the remains of the ship *Ben Ledi* which ran ashore in 1879; and the boilers of the steamer *Windsor*, wrecked in 1908 en route to Hong Kong, are high and dry on the reef. Pelsart's ill-fame far antedates these, however, the Dutch East India Company losing the *Batavia*—Pelsart was named for her skipper—to the Abrolhos in 1629 and the *Zeewyck* in 1727.

Under government permit a privately conducted camp had been established, which now in the hands of Mr. and Mrs. Gaze is a recreational outpost for Western Australia's fishermen—the waters of Pelsart abound in fish. A few visitors from outside Australia were registered, but I was the only American.

Pelsart is a sea-bird colony of a type found the world over. It is honeycombed with the burrows of shearwaters; thousands of terns of various species cover its tiny strip of land; scattered among them are cormorants, oyster catchers, tropicbirds, rails, and a number of small land birds. A casual visitor finds it bleak, but a fisherman or an ornithologist will not be

sorry he came. For the herpetologist, lizards are everywhere on the island; but, happily for others if not for him, there are no snakes.

Time fast running out and transportation troubles at their worst, I too soon had to see Pelsart dropping astern of the Geraldton-bound motorboat, and hurry back to Perth for the Sydney plane. Going east by air instead of by rail or sea gave me nearly a week for one more field trip. I took off from Perth at a minute to midnight; next morning I was in Sydney ready to start out for Ulong, on my last hunt.

Ulong is a little lumber mill town in New South Wales. Its close-by virgin forest and lightly cut areas proved excellent hunting ground. There are no hotels in Ulong, but the head of the nature club in its school and correspondent of the Australian Museum, Miss Joan Parbery, arranged for me to stay at her brother's home, where I was taken in as one of the family after I and my tank of spirits had landed by mail stage from Caramba. With the nature club in the field to help me, I soon wondered whether the tank would hold all the reptile treasures of Ulong.

Though lumbering had been going on for some time the forest did not look denuded. This region has considerable rainfall. During the dry season cutting is well within the forest; in the rainy season operations shift outward towards the edge, so that logging trucks

can work from the main roads of travel. The old log roads, grown over but still passable on foot, were most interesting to me. From the cover of the dense undergrowth which has sprung up along them many small but brilliantly colored birds would come out into the sunshine. Natives of the forest hard to catch

a glimpse of were the little wallabies which kept close to the heavy cover. Now and then a python (commonly called the carpet snake) is seen gliding through the undergrowth in search of a wallaby or some such animal as a victim for its coils.

Commonest reptiles around Ulong were insignifi-

The brown snake is common in Queensland and New South Wales. This one is swallowing a prickly lizard. (Photograph courtesy of J. R. Kinghorn)



*Leaf-tailed gecko, *Phyllurus cornutus*. About life size.
(Photo by Ione B. Stephens)*



cent lizards and snakes, most of which bury themselves in old logs and under loose bark of fallen trees. The forest abounds in small frogs and toads which lay their eggs in the pools of water on the forest floor and then disappear into the densest part of the jungle, seeking a hiding place under moss and dead leaves. Nevertheless, secretive as they are, I venture to say not many species escaped me, ably assisted as I was in the hunt by the Ulong nature club.

One, at least, of these obscure little amphibians made the newspapers back home in San Francisco, whether because rewrite men were hard up for something to report about a one-man collecting expedition, because of the exotic euphony of the place-name Ulong, or because someone hoped *Lechriodus fletcheri* would break the public jaw—I don't know. Anyhow, it was duly reported that one Joe Slevin had caught 33 specimens of one very small frog with two big names—in Ulong, of all places, and that outside this dim spot in Australia only Harvard's Museum of Comparative Zoölogy with two, and the British Museum, London, with one, had any.

Not only the expiring date on my visitor's permit but the approach of antipodean winter put an end to further profitable activities. After one last

night on a train I was in Sydney again—this time to prepare specimen tanks for shipment to San Francisco by steamer freight, and to check myself and personal baggage out for the clipper.

To bring the notes of three separate expeditions together into one smooth narrative has not been easy, and doubtless some events, places, and persons have been slighted, but now I must retrace my steps just far enough to recall some of the other stations in Queensland and New South Wales whose hospitality I enjoyed, and to mention my third "fairy godfather," Mr. William Kelly of Brisbane, who, leaving nothing undone to facilitate my movements, made it possible for me to visit such wonderful stations as Noondoo, Callendoon, Kolonga Creek, and Keera, and who hunted with me at his mountain retreat in the McPhereson Range, where some of my most valuable specimens came from.

On February 28, 1948, at one minute before midnight I boarded the clipper *Westward Ho*, eastbound. Our course set for Noumea, I watched the lights of Sydney fade. To me, after three wide-ranging seasons in the field with its wildlife, and pleasant sojourns with so many of its friendly people, Australia was no longer a strange land.

Moloch horridus, head enlarged. The spines, as hard and sharp as they look, make this lizard highly unattractive to brown snakes and other predators. (Photograph by Ione B. Stephens)



CONSERVATION

A Letter from Joel Hedgpeth

EDITOR, *Pacific Discovery*

SIR:

I have read with interest the letters by Messrs. Stalder and Elliott in behalf of the mining interests, and that of Mr. Croker stating the position of the California Division of Fish and Game.

To begin with the mining people, it is no surprise that they disagree with me, although they prefer to sidestep the basic moral of my piece. The damage to fish life is only one reason why placer mining should come to an end. From the viewpoint of an ecologist—one who is interested in the relationships of men and animals to their environment and each other—the damage caused by hydraulic monitors and dredges is far greater than the value of the gold "recovered." There are far more interrelationships involved in placer mining than my mining friends seem to be aware of, especially since California has now become a densely populated area. Mr. Elliott points out that there is a greater bulk of debris deposited behind the Bullard's Bar dam than has been moved into it by hydraulic mining for the same period. He has not, apparently, given any thought to the fact that erosion on a placer working does not stop when the mining stops. How much of that extra debris is cumulative erosions from old placer workings can only be determined by comparative study of a similar stream where there never has been any placer mining, but I suspect it is not a minor quantity. You cannot tear a cubic mile of earth out of a mountain side and call that the end of it. That is only the beginning.

This past year California has endured an acute water shortage. It is not reasonable that with one hand we should try to improve streams, protect watersheds and build reservoirs, and with the other hand cut away great chunks of our precious watershed for gold. Mr. Elliott is not a very good economist: gold did not help us out of the depression, the war did. Our next depression will be a matter of shortages in our basic resources, including water and forests, and gold won't help. It is time that our mining people realized that this is 1948, not 1848, and that gold is no longer a basic resource.

It is puzzling to understand Mr. Elliott's remark that F. H. Sumner and Osgood R. Smith, in their report to the U. S. Engineers (incidentally, partly reprinted in *California Fish and Game*, January 1940), "seem to be somewhat undecided about any actual ill effect (of mud or silt) upon the fish," when they plainly state: "This survey, as well as other observations, shows conclusively that very heavy continuous silting will greatly reduce, if not completely eliminate, salmon or trout." Every thorough biological study which has been carried out in a mining stream indicates a very low quantity of available fish food in that stream, and a low fish population. To be sure, fish do live in streams

where there is a large amount of silt from natural erosion, but salmon and trout prefer to spawn in the clearer tributaries, a trait pointed out in Sumner and Smith's report as well as by many observers cited in their report. The important difference between mining debris and natural erosion is that the mining debris is turned into the stream in late spring and early summer when under natural conditions the stream should be clear and filled with the insect life upon which the fish feed. Mining operations at this time also serve to cut down the oxygen supply in the water—during periods of natural run-off, the waters are cold and high and there is no oxygen shortage. That is why salmon can survive in the silted rivers of Alaska.

I will grant that I placed too much faith in hearsay evidence in the matter of the fish mortality below Bullard's Bar, but I am charmed to learn that the fish were not salmon but were steelhead. Since there is a fish-ladder at the Colgate dam, which has not been kept in operating condition since the debris dam a mile or so upstream was installed, it is evident that construction of the Bullard's Bar dam was the excuse for abandoning maintenance of this fishladder.

To turn to Mr. Croker's letter: While I may be pessimistic, I believe his letter is too optimistic. I am sure that neither he nor the Fish and Game Commission wishes to create the impression that the salmon will be better off if all the rivers are dammed, but this is precisely the idea the engineers are beginning to have as a result of certain events, and we now find, in their lists of proposed benefits, "The improvement of the stream for fish life." It is true that California now seems to have a greater salmon population than it has had for many years, and certainly the greatest for which we have any records. But this increase was evident as early as 1940, before Shasta Dam and Friant Dam were completed. The blocking of the Sacramento River by Shasta Dam on November 8, 1942, confined the salmon of that stream to some thirty miles of river bed below the dam. By distributing these salmon over this area between a series of restraining racks, and maintaining a relatively constant stream flow of low temperature water from Shasta Reservoir, the runs have been enabled to spawn successfully. There is a large salmon run in the Tuolumne River below LaGrange Dam, where there is usually enough water left in the river to sustain a salmon run. Water rights, however, have not been established in our courts of law for fish, and until they are, we will have such situations as have arisen below Shasta Dam, where threats to cut off the flow during the incubating period of the salmon eggs were averted only by concerted action and protest, and below Friant Dam, where the right to a minimum flow for the salmon runs in the San Joaquin River is still being debated by the California Division of Fish and Game and the Bureau

REVIEWS

THE TREES OF YOSEMITE. A popular account by Mary Curry Tressider with 34 linoleum block prints by Della Taylor Hoss. Stanford University Press. 1948. Second edition. xiv + 134 pp. \$2.00.

This attractive handbook of the trees of Yosemite National Park, California, was first published in 1932, and its well-deserved popularity has rightly earned for it the present second edition. Twenty-four trees that are found in the middle Sierra Nevada from the higher foothills to timber line are described affectionately by Mrs. Tressider who has known them intimately for many years, and they are artistically depicted in their most characteristic aspect by Mrs. Hoss, who has caught the spirit of the trees and the beauty of their foliage and fruits in her fine linoleum blocks. Three charts for the identification of the different families and species are given instead of formal keys (which frequently puzzle and discourage the amateur nature lover), and there is an additional chart which shows the distribution of Yosemite trees by life zones.

The second edition differs from the first in only a few small matters: the descriptions of a few trees have been amplified and the common names of others have been changed. The paper cover of the first edition was attractive enough with its colorful linoleum block of the incense cedar, but the linen cover (limp) of the second edition with its checkerboard of brown and buff giant sequoia cones is not only equally attractive but will be much more durable. The same clear typography that characterized the first edition will be found in the second.

of Reclamation. The success of the efforts below Shasta Dam has given the U. S. Engineers the impression they can block off that important portion of the river with a dam at Iron Canyon and replace this lost run by "rehabilitation" of tributary streams.

There is probably a biological limit to this sort of thing. It is pertinent to ask how the salmon began to come back just before the big dams were built. A reasonable hypothesis seems to be that throughout the course of the years the salmon runs became adjusted to the changes caused by man in the streams of the Central Valley. It remains to be seen whether the additional, and far more extensive, changes now under way and planned for the near future will find the salmon capable of immediate readjustment, or induce a new low period in the salmon population. An equally reasonable hypothesis is that we are witnessing some sort of long period cycle in abundance and that there will always be lows and highs in the salmon population, granted comparable environmental conditions. It will require many years of careful counts to shed light on these problems.

Undeniably, California is short of water. The Cen-

It is not easy to imagine a more appealing book with which to begin the study of our Sierran trees. May it continue to lead ever-increasing numbers to the appreciation of their lasting value and beauty!

JOHN T. HOWELL

Department of Botany
California Academy of Sciences
San Francisco

STRANGE PREHISTORIC ANIMALS AND THEIR

STORIES. By A. Hyatt Verrill. L. C. Page & Company, Boston. 1948. xvi + 262 pp. Illus. \$3.75.

In an attempt to popularize part of the great store of accumulated data about life of the past Mr. Verrill has written a highly fantastic book which is hardly above the category of comic books. The author has ignored most of the great literature of Paleontology and has presented his own peculiar speculations without respect to the evidence. In a half hour's time a competent vertebrate paleontologist [*a colleague of the reviewer.—Ed.*] scanned the book and pointed out numerous serious statements completely at variance with well-known facts about the animals discussed. The book belongs in the realm of fiction and should not be presented as anything else.

J. WYATT DURHAM

Department of Paleontology
University of California
Berkeley

tral Valley Project was designed to meet some of this shortage, on the basis of the population and requirements of 1938. Now the population has increased to such an extent that the Central Valley Project is no longer adequate. As long as the population increases at the present abnormal rate by immigration, this vicious spiral will continue, and we will be perpetually short of water. Placer mining is even less justified than it was ten years ago, and may eventually be completely outlawed as a matter of economic necessity, and the salmon will also be no more. In the same issue of *Pacific Discovery* which included Mr. Elliott's letter there was a review of Fairfield Osborn's *Our Plundered Planet*. Everyone interested in the future of California should read that book, as well as William Vogt's *Road to Survival*, which is a more thorough treatment of the same theme. Perhaps these gentlemen have overstated their case, in terms of the time limit for our survival on this planet, but the danger is real nevertheless, and California, once one of the most favored of areas, is now dangerously close to the edge.

JOEL W. HEDGPETH

Port Aransas, Texas, September 22, 1948.

THE THIRSTY LAND. The Story of the Central Valley Project. By Robert de Roos. Stanford University Press. 1948. xii + 265 pp. Illus. \$4.00.

Few people pause to realize the extent to which the winning of the West was bound up with water. From the day a covered wagon pulled out of Independence, Missouri, in 1848 or 1849, till—please God—it arrived on the Pacific slope six or eight months later, fatigue, hardship, disease, danger from hostile Indians—all these were secondary to the problem of sufficient water. Caravans proceeded as far as they could in river valleys, left the rivers reluctantly, struggled from water-hole to water-hole, scaled mountains with a view to the water-courses on the other side.

But the problem was not always too little water—sometimes it was too much. Streams had to be forded. Floods came. Snow gave trouble, and in one historic case practically wiped out a major expedition—the Donner party. West of the high mountains floods were a recurrent problem; and it is worthy of note that a familiar type of California architecture—the high one-story cottage with basement above ground and a dozen steps leading up to the front door—was designed for the Sacramento Valley with the primary purpose of keeping water out of the living-room.

Well, such was and is the great western problem, and in particular the California problem—how to have enough water when you want it and where you want it, and conversely how to keep your barn from taking off like Noah's Ark when the spring thaw comes in the mountains.

Mr. de Roos, a newspaper man and a good one, has given a terse, fast-moving account of California's water problem and of the efforts, private and public, to cope with it, from the Gold Rush days right down to the present time. Common law, riparian rights, irrigation districts, reclamation projects, big versus little landowners, power politics, internecine strife of government agencies—these represent a random sampling of the topics treated.

This is an important book because it deals with a vital subject. It is a useful book because it is the first comprehensive story of the Central Valley Project. It is also a controversial book, because it deals with a highly controversial matter, and further because the author has made no visible effort to avoid controversy. He likes the Bureau of Reclamation and he doesn't like private power companies nor the Army Engineers, and he says all of these things right out loud on the first page of his Preface.

Mr. de Roos entitles one of his chapters, "We Ain't Mad at Nobody." This reviewer predicts that a lot of readers are going to be mad at somebody. Hold your hat, watch your blood pressure, and don't say we didn't warn you!

ROBERT C. MILLER

California Academy of Sciences
San Francisco

THE GREEN WORLD OF THE NATURALISTS:

A Treasury of Five Centuries of Natural History in South America. Selected and annotated with biographical sketches and introduction by Victor Wolfgang von Hagen. Greenberg: Publisher, New York. 1948. xix + 392 pp. \$5.00.

"Great treasure house of the naturalists" South America is indeed, as the jacket says. Whether Mr. von Hagen has creamed off "the best and most representative examples" of the writings of twenty-five discoverers, explorers, chroniclers, great naturalists—Humboldt, Darwin, Wallace, Bates, Hudson, Beebe, to mention those who come at once to mind—is a question of individual choice. Mr. von Hagen's is doubtless as good as any. Those for whom this literature is a new reading discovery will proceed at once from this anthology to the several contexts—for to read part is to want all. Others already at home in Beebe's or Hudson's pages will be further enriched by H. M. Tomlinson, Richard Spruce the botanist, Edward Whymper, climber of the Andes, our American ornithologists Frank M. Chapman and Robert Cushman Murphy, and—turning to beginnings—by those after Columbus whose amazed, curious, often credulous eyes first raised the new, green continent out of the Unknown.

D. G. K.

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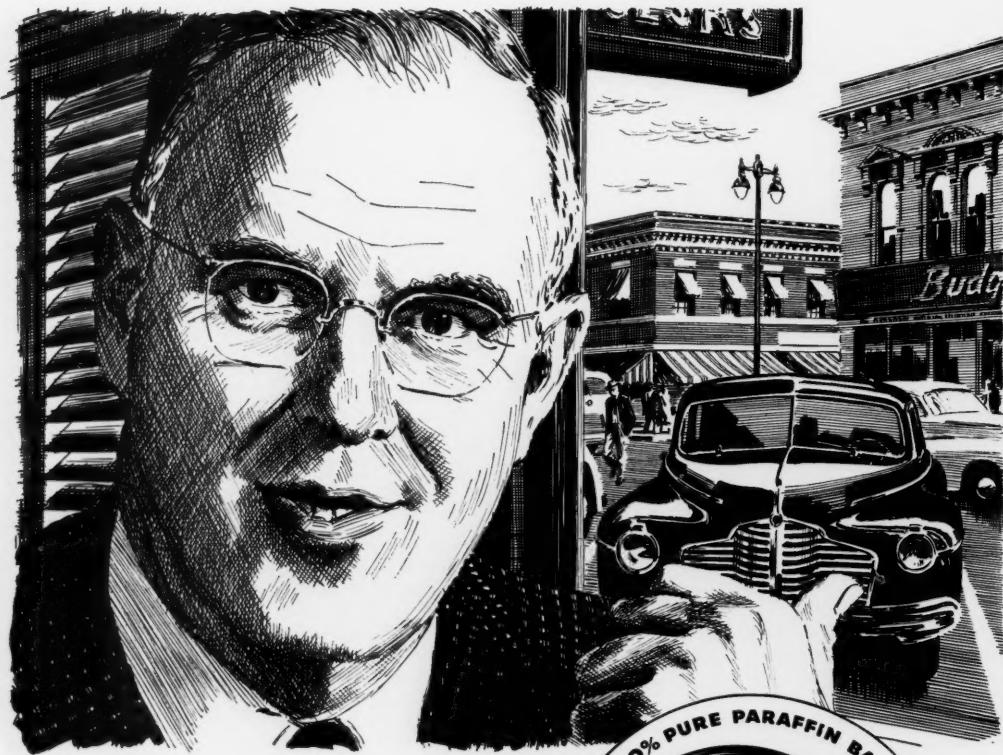
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